A Brief Guide to
The Geology of Old Aberdeen

*At the end of this excursion guide is a glossary of technical terms used within. The first time a term is used it is shown in **bold italics** in the text. The glossary is also cross-referenced.*

LOCALITY 1 THE MESTON BUILDING

The front of the Meston building is made of at least four different types of ***granite***, all from the local area. Note the variations in colour, grainsize and internal structure (e.g. alignment of mineral grains). Some of the granite blocks contain sub-rounded, partially flattened inclusions of the black, platy mineral, ***biotite***. These are not of the same age as the granite, but are fragments of pre-existing rocks picked up by the granite during its emplacement. Some very coarse grained pegamtites are present here and there [visit Haddo House and examine the lower part of the 1878 extension near the concert hall for some very fine tourmaline pegmamtites].
To the Bedford Road side of the building, cobbles set in cement are of a great number of varieties, including granite and ***metamorphic rocks*** formed by the deformation and heating of older rocks.

LOCALITY 2: SIR DUNCAN RICE LIBRABRY RAMP

The library ramp is made of Caithness Flags – that is the term used to describe the type of rock that is used for making paving slabs. "Flaggy" is a quarrymann's term for a rock that plits into thin slabs ('flags') that are suitable for paving. This material is also used on parts of Union Street and the areas around Back Wynd and Belmont Street in the City Centre. The rocks are Devonian in age (400-360 Ma) and were formed in a major inland lake which existied at that time, called the ***Orcadian Basin***. The rocks preserve parallel bedding that occurs on a millimetre scale, often referred to as lamination. Note the colour variation in the laminae – the orange coloured stripes probably contain dolomite (magnesium carbonate). This typ of sedimentary accumulation is typical of the type of sediment that accumulates in large lakes. The individual laminae may be desposited seasonally, and their number and thickness can tell us about past climate. On the sides of the ramp and on its surface about ¼ of the way up, you may see evidence of a white crusty deposit. This is calcium carbonate (calcite) that has been dissolved by water percolating through the beds and redepositing calcite on the surface. Note that where there is a white deposit it seems to eminate from the junction between two slabs. This has occurred since the ramp was laid in 2014.

LOCALITY 3: THE LARGE GREY STONE SCULPTURE STICKING UP ON AT THE BOTTOM OF THE RAMP – 'WATERLINES'

This sculpture is made of a limestone known in the stone trade as Kilkenny Blue Limestone or marble. Careful inspection of its surface reveals fossils of brachiopods, gastropods, crinoids and coral. Technically this is not a ***marble*** because it has not been metamorphosed. It is sourced from County Kilkenny in Eire and is of Lower Carboniferous age about 330Ma.

LOCALITY 4: ST MARY'S BUILDING (GEOGRAPHY DEPARTMENT)

The porch of St Mary's is faced with a fine-grained greenish rock, which is quite clearly easily split into thin slabs. This rock was formed by the ***metamorphism*** of a fine-grained mudrock and contains small black flakes of the mineral ***biotite*** which grew during metamorphism, and were not originally laid down in the form of a sediment. The silky, greenish surface of the slabs results from the occurrence of many tiny aligned plates of the greenish mineral ***chlorite*** giving this rock its characteristic sheen. There is nothing else of interest in the geography building.

ABOUT FACE AND PROCEED TOWARDS THE HIGH STREET PAUSING BRIEFLY IN THOM'S PASSAGE (1A ON MAP)

A single flag of andalusite schist makes up one of the flagstones of the pavement. Next time you make a visit to *Pitmedden Gardens*, note that the stone steps down to the Par Terre are of the same material. Original locality unknown, but charactersitic of the metamorphic aureoles of many of the Aberdeenshire gabbros.

LOCALITY 5: BY THE POSTBOX ON THE EAST OF THE HIGH STREET. (back of Taylor Annexe).

Here the stone used to make the ornamiental garden, that looks as if it should have a fountain in the middle of it but doesn't, is made of a type of granite. This is a coarsely crystalline rock with individual mineral grains visible to the naked eye. Under close inspection, it becomes clear that each mineral grain has a different colour and shape. It was not laid down in layers and the interlocking nature of the crystals identifies this as an igneous rock. Very large broadly rectangular ***(euhedral)*** orthoclase feldspar phenocrysts (larger crystals that the main body of the rock) exhibit obvious twinning and there is a rudminentary orientation of the

crystals due flow of the magma when molten. The development of crystals of this size and perfect shape is extremely rare. In nature. Jolly good stuff.

LOCALITY 5: NEW KING'S & ELPHINSTONE HALL.

The front of New King's is made up of dressed ***sandstone.*** On the left-hand side of the front door, ***bedding planes*** and ***lamination*** can be clearly seen. Where bedding planes are not parallel sandstones are said to be cross-bedded. Dark reddish clasts of mud which have been picked out by weathering are also visible. Note that these clasts are aligned parallel to the bedding in the sandstone. These mud clasts were formed by the erosion of fine-grained muddy material in a river, and their subsequent inclusion into the sandy material. The clasts are only very slightly older than the sandstone in which they are included. Note that the grainsize of these sandstone blocks is quite variable both within and between blocks.

Similar structures can be seen on the front of Elphinstone Hall facing the cricket pitch. In addition, cross-bedding is evident here, as are small channel-like structures formed by the changing strength and direction of current and sediment supply in a river. It is possible to demonstrate that some of the blocks are upside down in relation to their original depositional orientation. Small ***fault***s, which were generated not long after the deposition of the sandstone can also be seen.

These sandstones are Old Red Sandstone of Devonian age, in the region of 400 million years old. Their internal structures (e.g. cross bedding, channels etc.,) and the presence of mud clasts are indicative of deposition by a river.

LOCALITY 7 NORTH WALL OF KING'S CHAPEL

Take time for a brief diversion to the north-facing side of King's Chapel. Observe the tomb of Bishop Elphinstone. Originally designed to be in the nave of the chapel, the doors were not wide enough to allow the tomb to be placed inside the chapel, hence its current position. Just visible below north-facing windows of the chapel, are three slabs of sandstone which have rather weathered inscriptions of two fish and a cross carved upon them. These are the original consecration stones that were laid when the chapel was built. The fish and cross are common Celtic Christian emblems. These stones were uncovered during the conservation work that was done on the chapel in the early part of the millenium. These stones would originally have been blessed in a religious ceremony, and until the ceremony took place, the building was not a designated place of worship, hence the term "consecration stones". The upper-left quandrant of the current University coat-of-arms bears elements of these carvings.

LOCALITY 8: CROMWELL TOWER

Cromwell Tower is the oldest building at King's College. Much of it is made of granite and other igneous rocks, but the detailing around windows and doors is largely of sandstone, similar to that on the pillars of the Taylor Building. Looking around the inside of the quad, a large variety of rocks types can be seen. The large supporting buttresses of the chapel are granite, but the upper parts of the chapel, particularly the ornamental stone, is sandstone. This is simply because at the time the chapel was built, the technology was available to carve the relatively soft sandstone, but not granite. Granite was not able to be carved until the early 19th Century. Note also that the sandstone ***weathers*** more rapidly than the granite, and has thus had to be replaced in places.

LOCALITY 9; WALK FROM ELPHINSTONE HALL TO ST MACHAR CATHEDRAL VIA DUNBAR STREET & THE CHANONRY

Note the following:

Most of the modern buildings on the campus are made of horrible concrete blocks. However, an attempt has been made on the newest halls of residence (e.g. New Elphinstone) to use composite blocks made up of cement and granite chips to give a more "granitty" look to the buildings. Fails miserably though.

The walls of Dunbar Street and the Chanonry contain huge variety of rock types. Folded metamorphic rocks can be seen in the right hand wall of the Chanonry, and flat ***flagstones*** have been used to cap part of the wall. ***Schist*** and granite are also present.

Near the entrance to Chanonry Lodge (the Principal's House - no geological hammers please), the kerb stones are made of a fine-grained black rock which has a rather featureless appearance. This is the igneous rock ***dolerite.*** The kerbstones probably originate from the Midland Valley of Scotland where dolerites are common.

LOCALITY 10; ST MACHAR'S CATHEDRAL.

According to legend, St Machar founded a site of worship in Old Aberdeen in about 580AD. Much of the current structure days from the 16th Century, but the granite from the older buildings was probably used repeated times. After the execution of William Wallace in 1305, his body was cut up and sent to different corners of the country to warn other dissenters. His left quarter ended up in Aberdeen and is buried in the walls of the cathedral. The Cathedral is built largely of granite, with some carved sandstone for ornamentation. The granite is coarser grained than that on the Meston Building, and can be seen to be quite weathered with a brittle-looking surface expression. Indeed, (don't do this please) it is possible to flake bits off with a fingernail. This is probably because the granite was quarried from very near the surface, and not in a deep quarry like Rubislaw. The lack of mechanized technology at the time of the building of the cathedral did not allow deep quarrying. Because the granite was quarried from the near surface, it had already been attacked by the agents of weathering before it was used as a building stone.

Above the west-facing door there are remnants of some sandstone coats-of-arms. However, these are now largely missing as a result of the relative ease with which the sandstone weathers, particularly from acid

rain. The granite is more resistant to weathering than sandstone. Towards the altar end of the there have been extensive repairs made to the window surrounds (mullions) where weathering has all but destroyed to original sandstone.

A variety of granites and slate have been used over the centuries to make the gravestones and monuments in the graveyard. A particularly spectacular pink granite makes up the memorial to one of Aberdeen's pioneer stonemasons, near the rear entrance to the cathedral.

Close to the entrance or the Cathedral on the right if you are facing the entrance, an unusual grey gravestone is lying flat on the ground. Close inspection reveals the presence of fossils which confirm a Carboniferous age for this limestone. This may well be from the same source as the limestone at locality 2.

LOCALITY 11; SEATON PARK

Just inside the entrance to Seaton Park, on the left, are a series of large boulders representing many of the building stones seen in Aberdeen. The first test is to read the inscriptions, which are normally full of rotting leaves (the author normally cleans them out about september time ready for the start of term). Granite from Correnie, Kemnay, Rubislaw, Dyce and Peterhead are here, as well as basic rocks from Behelvie.

Glossary

Bedding plane: a surface which is parallel to the surface of deposition of a ***sedimentary rock***. The original attitude of a bedding plane should not be assumed to have been horizontal.

Biotite: one of the ***mica*** group of minerals, rich in MgO & FeO.

Cross-bedding: a series of inclined ***bedding planes*** having some relationship to the direction of wind or current flow, angle of rest of the sediment and the rate of supply. Cross beds do not form neat sets of parallel bedding planes, as there is a marked angular discordance between sets of cross beds.

Dolerite: a medium grained ***igneous rock***, dark in colour. It is made up predominantly of minerals rich in MgO, FeO and CaO but poor in SiO_2

Euhedral: well-shaped crystals

Fault: a fracture in a rock along which there has been an observable amount of displacement. The nomenclature of the geometry of faults is highly complex.

Feldspar: A potassium±sodium±calcium-bearing alumino silicate mineral. The commonest mineral specise on tre planet.

Flagstone: a ***sandstone*** containing platy ***mica*** minerals, which is capable of being split into thin sheets. It is because micas have a sheet structure that the splitting is possible.

Granite: a coarse grained ***igneous*** rock consisting essentially of quartz (SiO_2), feldspars (compounds of Si, Al, Na, Ca and O) and micas (platy minerals which are compounds of Si, Al, Fe, Mg, K, O, OH^- and F).

Igneous rocks: One of the three main groups of rocks, often regarded as the primary source of the material making up Earth's surface. They are characteristically crystalline and crystallized from molten magma

Lamination: the development of thin, discrete layers in a rock. Common in relatively fine-grained ***sedimentary rocks***.

Marble is formed when limestone or other $CaCO_3$-rich rocks are buried and heated resulting in recrystallization of the carbonate minerals.

Metamorphism, Metamorphic rocks: rocks in which changes to the mineral content and gross structure have been brought about by the agencies of heat and pressure. They may have characteristic banding which is often folded. In other cases they have a platy appearance and split easily into slabs; roofing slates are commonly made of metamorphic rocks.

Mica: a group of minerals made up of varying proportions of Si, Al, Fe, Mg, K, O, OH- & F. They are made up of thin sheets and often become aligned during ***metamorphism*** resulting in the formation of ***schist***. See also *flagstone*.

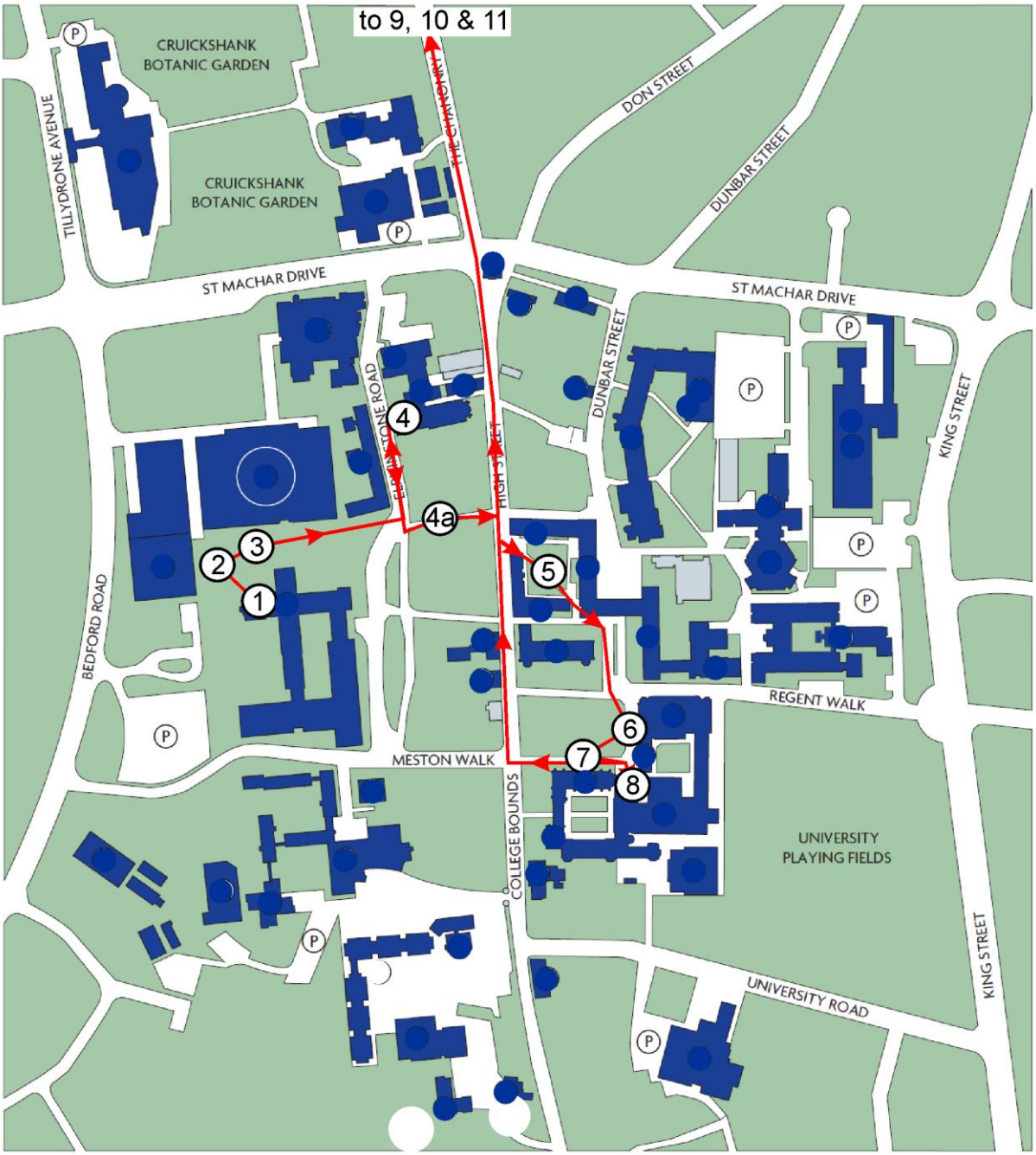
Orcadian Basin. A major inland lake that existed during the Devonian. It extended from Forfar to the Orkeny Islands and the laminated sediments that were deposited in it are exposed along the east coast of Caithness & Sutherland and on Mainland, Orkney.

Sandstone: a ***sedimentary rock*** made up predominantly of quartz, with subordinate feldspars (see ***granite***). Sand-sizes particles can be transported by the action of by wind or water, and the resulting deposits have characteristic internal structures which record their depositional history. The grainsize of sandstone is in the range 1/16 mm to 2 mm.

Schist: a type of ***metamorphic*** rocks, rich in platy micas, which shows a strong parallel alignment of the platy minerals, normally ***micas***, which is clearly visible in hand specimen.

Sedimentary rocks: rocks formed from material derived from pre-existing rocks by the processes of weathering and erosion. Sedimentary rocks are laid down in discrete layers (***bedding planes*** and ***lamination***) which can be seen in outcrops and building stones.

Weathering: the mechanical and chemical break-down of a rock due to exposure to the Earth' surface or shallow circulation of fluids. Badly weathered rocks simply disintegrate. Chemical weathering is particularly problematic with respect to historic buildings because of acid rain and vehicle fumes.



Map of Old Aberdeen showing localities mentioned in the text. Note that St Machar's Cathedral is off the map to the North.